HP BladeSystem p-Class rack-centralized (3U) power solutions

technology brief, 2nd edition

Abstract

HP provides two power subsystem alternatives to meet the requirements of various BladeSystem deployments. These two options are the HP BladeSystem p-Class 3U power enclosure (rack-centralized) and the HP BladeSystem p-Class 1U power enclosure (enclosure-based). This technology brief describes the HP BladeSystem p-Class 3U power subsystem and the various possible configurations using the HP BladeSystem p-Class server blade enclosure and different combinations of server blades.

This technology brief was written with the assumption that readers are familiar with the components of the HP BladeSystem p-Class infrastructure. For more information about the infrastructure components, see the HP website at www.hp.com/go/bladesystem/.

Acronyms in text

The following acronyms are used in the text of this document.

Table 1. Acronyms

Acronym	Acronym expansion
AC	Alternating current
DC	Direct current
EEPROM	Electrically erasable programmable read-only memory
iLO	Integrated Lights-out
NA/JPN	North America / Japan
RETMA	Radio Electronics Television Manufacturers Association (rack spacing)
ROM	Read-only memory
U	Unit of measurement for rackmount equipment (U is 1.75in. or 4.44cm)
VAC	Volts alternating current
VDC	Volts direct current

Overview of HP BladeSystem p-Class power infrastructure

HP offers two power subsystem alternatives to accommodate a range of environments. These two options are the HP BladeSystem p-Class 3U power enclosure (rack-centralized) and the HP BladeSystem p-Class 1U power enclosure (enclosure-based). Each power enclosure holds up to six hot-plug power supplies and contains a power management module for monitoring the power infrastructure. ProLiant BL p-Class bus bars distribute power from the 3U power enclosures to the server blade enclosures and drastically reduce cabling. All server blades, interconnect options, and management tools are fully compatible with either power subsystem. The focus of this paper is the BL p-Class 3U power subsystem. For more information on the HP BladeSystem p-Class 1U (enclosure-based) power enclosure, please refer to the HP technology brief available at this URL: http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00588442/c00588442.pdf

The HP BladeSystem p-Class 3U power subsystem provides hot-plug, fully redundant power for multiple server blade enclosures that would typically be deployed in racks in a data center environment. Single-phase or three-phase power options are available.

Power enclosure

Customers can use either a single-phase power enclosure or a three-phase power enclosure. There are four different 3U power enclosures:

- Single-Phase NA/JPN (redundant 200 – 240V AC, L6-30p 30 amp inputs)
- Single-Phase International (redundant 200 – 240V AC, IEC 309 4-Pin 32 amp inputs)
- Three-Phase NA/JPN (redundant 208V, L15-30p 30 amp 3-phase delta 4 wire inputs)
- Three-Phase International (redundant 200/380 – 240/415V, IEC309 5-pin 32 amp 3-phase wye 5 wire inputs)

The single-phase power enclosure holds up to four, 3000-watt hot-plug power supplies. The three-phase power enclosure holds up to six hot-plug power supplies.

Customers who have a direct facility power source of –48 VDC can use the DC Power Connection option kit to distribute power directly to the server blade enclosures without the use of the power enclosures.

Power management module

Attached to the back of each server blade enclosure is a server blade management module. The management module is a self-contained microcontroller that communicates with the Integrated Lights-Out (iLO) management device on each server blade. The server blade management module also communicates with the power management module in the power enclosure. The power management module monitors the power supplies and power enclosure, delivers alerts and status data to the server blade management module, supplies power zone information, and determines during the auto power-up sequence if adequate power is available for newly installed server blades.

Power distribution

Power is carried from the power supplies in the power enclosure(s) to the server blade enclosures through one of three power distribution options: mini bus bars, scalable bus bars, or a bus box for a one-to-one connection. The bus bars are attached directly to the RETMA rails in a rack and provide power independently to each side (A and B) of the server blade enclosure. The Appendix gives additional details about the power distribution options.

Power zones

Setting the power zone associates the server blade enclosure with the power enclosure that supports it. This allows power information and alerts to be sent to the proper power management module or server blade management module when power conditions change. For example, if an administrator removes a power supply from an enclosure, the information is sent to the server blade enclosures that are affected (the ones in that power zone).

Power zones also define the startup sequence of the server blades. The server blade enclosures and the power enclosures in the rack communicate to ensure that the server blades and enclosures are powered up in sequence rather than all at once, to prevent an extremely high load being placed on the AC infrastructure. The power-up sequence always runs from the top of the rack, top left server blade through the top and bottom row of the server blades in that enclosure (if HP ProLiant BL30p or HP ProLiant BL35p server blades are installed). The sequence then proceeds down to the next

enclosure and continues until the bottom right server blade in the bottom server blade enclosure is powered up.

In a rack that contains many server blade enclosures, the sequencing process may cause a significant time delay which could exceed 5 or 10 minutes before the last server blade powers up. However, this is preferable to the alternative—the possibility that the main breakers trip due to the excessive load on the AC infrastructure as all the server blade enclosures try to power up simultaneously.

The "Properly configure power zones" section under "Recommendations" in this paper describes power zones in more detail.

How server blades power up

For a p-Class server blade to power on, the necessary power must be available from the rack-centralized power subsystem. The iLO management processor on each server blade verifies with the power management module that there is sufficient power before automatically powering on the server blade.

Once iLO receives a power-on request, it reads the EEPROM on the server blade to determine the maximum blade wattage that could be required by a fully configured server blade. The iLO management device sends a request for that wattage amount to the enclosure management module in the server blade enclosure, which then forwards the request to the power management module in the power enclosure. If—without exceeding the maximum power load—sufficient power is available to operate the additional server blade at its peak load and to meet redundancy requirements, then the power subsystem signals that the server blade may power up. If there is not enough power available, the iLO management device continues to retry the power-on request at 15-second intervals. After one minute, iLO continues retrying the power-on request in 5-minute intervals to reduce traffic on the communication bus.

After a server blade powers up, the ROM and iLO collect data about the actual server blade hardware configuration. The data allows the power management module to adjust the power allocation for that server blade to the actual maximum wattage required.[1] This increases the remaining power available for other server blades to be installed.

NOTE: Power for disk drives is always reserved and is never returned, even if no drives are installed, as a drive could always be hot-plugged into the system while it is operating.

Because the initial request is made for maximum power rather than based on the actual configuration, the server blade may not automatically power up even though there is sufficient power available.

Manual power on

Occasionally, an administrator may want to power on a server blade even when the power management module indicates there is insufficient power—for example, when a non-redundant power configuration is adequate. The iLO management device allows administrators to perform a power override on the server blade in either of two ways: by pressing the server blade power button down for at least 5 seconds or by selecting the manual override button from the iLO virtual power button. The manual override must be used very carefully to avoid possible loss of service and data.

[1] This functionality is not available for the HP ProLiant BL40p or the first generation HP ProLiant BL20p.

Special considerations for users of facility DC power

It is important to note that if a customer uses a facility DC power source, iLO assumes that there is a limitless supply of –48 VDC. Therefore, the iLO management device on the server blade does no calculations to ensure that adequate power is available to power up another blade; a newly installed server blade is always allowed to power up in a BladeSystem configured to use facility DC.

Combining single-phase and three-phase power enclosures

It is possible to use both single-phase and three-phase power enclosures in a single power zone of a rack.[2] If multiple 3U power enclosures are combined in a rack in the same power zone, the power management firmware selects one of the power management modules to manage all the power redundancy calculations for that power zone. The power firmware selects which is the "master" power management module for a specific power zone. The master power management module keeps track of all power-related calculations for both power enclosures, such as amount of power available and redundancy requirements.

Managing power consumption

HP ProLiant BL server blades include HP Power Regulator, a firmware utility that enables system administrators to manage the power consumption of server blades. This utility takes advantage of Intel processors that allow their power states to be monitored and controlled with software. A processor on a server blade can be set to full power (maximum operating frequency or operating voltage) when applications demand it and later returned to a lower power state when application activity is reduced.

Unlike software solutions that take only a periodic snapshot of application activity, the ROM-based HP Power Regulator collects and analyzes all system activity to ensure maximum efficiency. Using automated, policy-based power management allows the system to operate at peak efficiency while maintaining performance goals. A static power saving mode allows the administrator to set the server to run continuously in its lowest power state for maximum power conservation.

Since HP Power Regulator is a ROM-based utility, it is independent of operating system constraints. Key benefits of the HP Power Regulator include:

- Reduced cooling costs from lowered BTU generation by equipment
- Increased compute capacity for a given facility by allowing more installed servers
- Compatible with Intel Speedstep® technology
- OS independent, ROM-based utility that does not require software upgrades
- Multiple modes (dynamic and static) of power management
- Easy, flexible deployment on single or large systems through the iLO scripting interface

Additional information on the HP Power Regulator is provided in the paper titled "Power Regulator for ProLiant," available from www.hp.com/servers/iLO.

[2] See "Properly configure power zones" under the "Recommendations" section for additional details about the power zones.

How workloads affect power requirements

Power requirements can be categorized into idle, maximum, and typical workloads.

Idle power requirements can be defined as the amount of wattage required to leave all servers powered on, but not executing any applications. In general, when all server blades connected to the power subsystem are idle, the HP BladeSystem power subsystem draws approximately 60 percent of the maximum power level.

The maximum load for any configuration is calculated using the HP BL p-Class Sizing Utility.[3] The value is calculated with all configured components in the system running at 100% utilization.

Typical, or actual, power draw is determined by the percent average server utilization of all applications running on the server blades. This value is not just processor utilization but includes the utilization of memory, hard drive and other system components. Therefore, typical power draws are unique to each customer environment and are usually much lower than the maximum power calculated by the sizing utility. Table 2 shows approximate percentages of the calculated maximum power based on average utilization rates. For this table, average utilization rate is defined as the average application utilization rate across all server blades connected to a specific power subsystem.

Table 2. General rules of thumb for correlating utilization rates to maximum power load

Average utilization rate	Approximate percent of maximum power load
Idle – 65% utilization	60 – 75% of max. power
65 – 80% utilization	75 – 85% of max. power
99% utilization	90% of max. power

Rack-centralized power configuration options

Several options are available for configuring the HP BladeSystem p-Class 3U power enclosure. There are two different p-Class server blade enclosures – the standard HP p-Class server blade enclosure and the HP p-Class server blade enclosure with enhanced backplane components. The HP BladeSystem p-Class 3U power enclosure can be configured for either of these blade enclosures or for a combination of the two.

Upgrading the standard HP p-Class server blade enclosure

The standard p-Class server blade enclosure has been replaced by the HP p-Class server blade enclosure with enhanced backplane components. However, the standard p-Class server blade enclosure can be upgraded using the Server Blade Enclosure Upgrade Kit, which contains enhanced backplane components and enables a field upgrade of a standard server blade enclosure. When upgrading standard server blade enclosures that use mini bus bars, the dual-power input kit for mini bus bars allows the mini bus bars to support a second power enclosure. This enables the power subsystem to provide maximum power redundancy using the enhanced server blade enclosures.

[3] The Sizing Utility is available at http://h30099.www3.hp.com/configurator/calc/BL p-Class.xls

Firmware requirements

Enhanced server blade enclosures require firmware revision 2.03 or higher. The management modules on the server blade enclosure and on the power enclosure must have the same firmware version release. All power enclosures within a rack must have the same firmware release. Firmware may be downloaded from the HP website at this URL:
http://h18023.www1.hp.com/support/files/server/us/download/24088.html

Power distribution for HP p-Class server blade enclosures

The HP BL p-Class system with enhanced backplane components has a centralized, redundant power subsystem which includes hot-plug power supplies, power enclosures, and ProLiant BL p-Class bus bars that distribute power to the system. This power infrastructure system allows the use of single-phase or three-phase AC power.

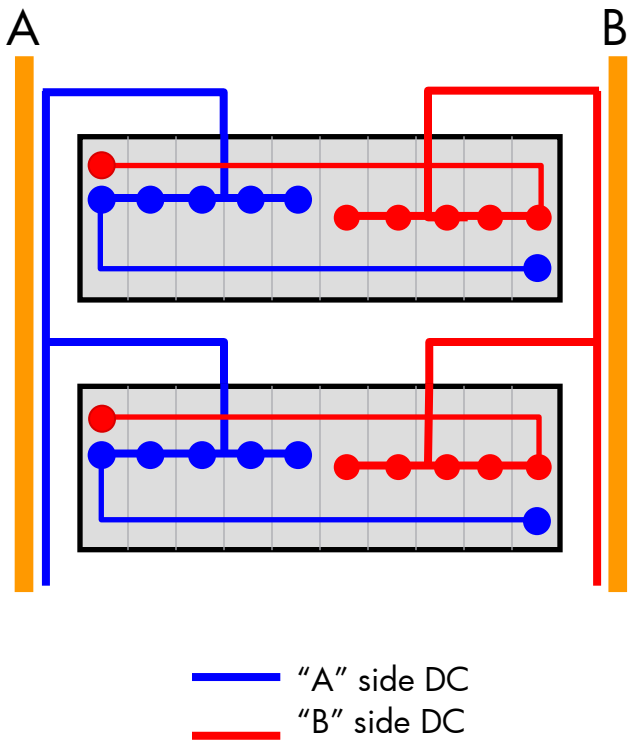
All HP ProLiant BL server blades except the BL30p and BL35p[4] install directly into the 6U HP BladeSystem p-Class server blade enclosure with enhanced backplane components. To support double-density server blades, the enhanced server blade enclosure has a signal and power backplane (referred to as the split power backplane) that allows for the physical connection of and support for the power loads of up to 16 server blades in a single server blade enclosure.

The enhanced server blade enclosure with the split power backplane is able to:

- Route power to up to 16 server blades.
- Support a higher input current and total input power than the shared power backplane in the standard server blade enclosure.
- Separate the DC power into the right and left sides of the server blade enclosure so that half the blades in a server blade enclosure are powered by side A (bays 1 – 4) and half by side B (bays 5 – 8). See Figure 1.

[4] The HP ProLiant BL30p and BL35p server blades require the HP BladeSystem p-Class blade sleeve. Each blade sleeve supports one or two BL30p/ BL35p server blades. The blade sleeve is installed into the HP BladeSystem p-Class server blade enclosure, which accommodates up to 8 blade sleeves.

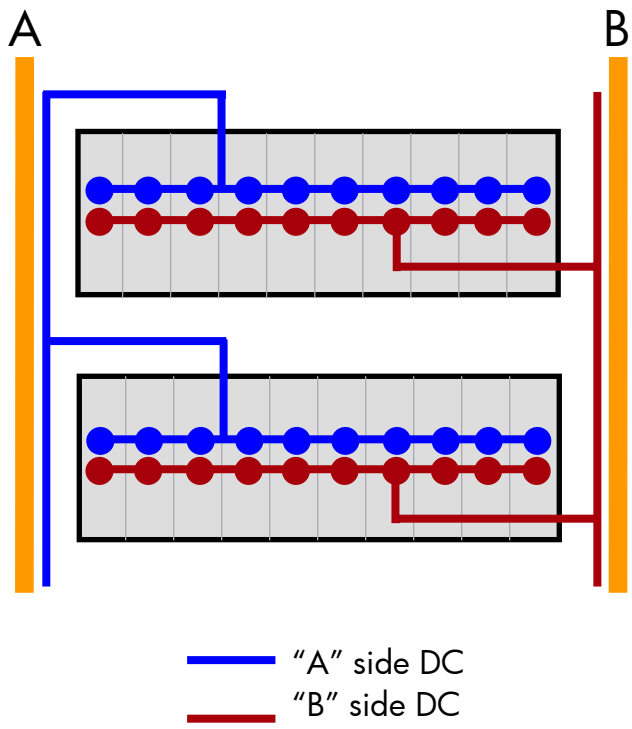
Figure 1. In the enhanced server blade enclosure, power supplies on side A distribute power only to side A server blades, while power supplies on side B distribute power only to side B server blades. Both sides A and B supply power to the interconnect bays and the enclosure management module.



Power distribution for standard (legacy) server blade enclosures

Within the standard server blade enclosure, a shared power backplane distributes the DC power from each independent bus bar (or bus box) across all ten server blade and interconnect bays (Figure 2).

Figure 2. In the standard server blade enclosure(s), the shared power backplane distributes power from each side (A and B) of the power supply enclosure across all ten bays of the server blade enclosure.



The standard server blade enclosure supports first, second, and selected third generation ProLiant BL20p blades, as well as the ProLiant BL40p series server blades. Refer to the HP BladeSystem enclosure compatibility matrix for information on which server blade models are supported in the standard server blade enclosure.[5]

AC redundancy considerations in server blade enclosures

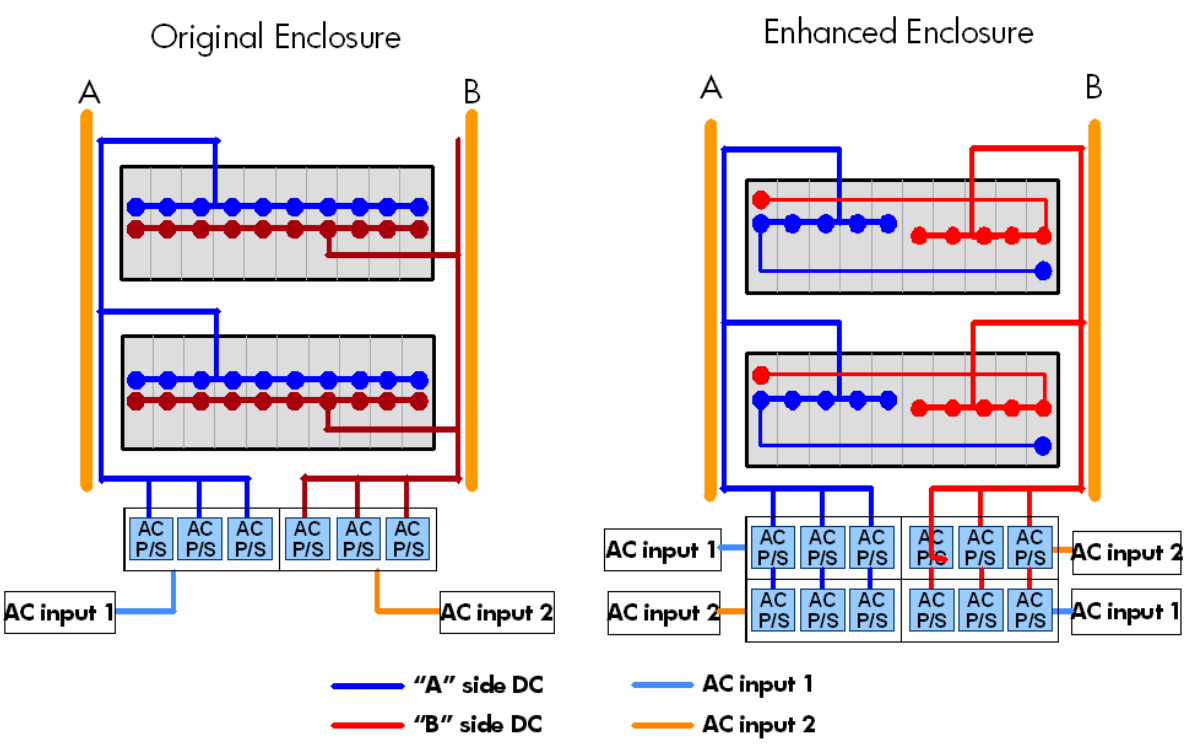
The power management firmware (version 2.03 or higher) calculates redundancy based on the type of server blade enclosure. For enhanced server blade enclosures, the power supplies on each side of the power enclosure are required to power the server blades on that same side, both the interconnect bays, and the enclosure management module. For standard server blade enclosures, each side of the power enclosure must be able to power up all the server blades and interconnects in that enclosure.

It is important to note that the interconnect bays and the enclosure management module continue to share power from both sides (A and B) of the power subsystem. This allows both interconnect modules as well as internal chassis communication to continue in the event of a power failure from a single AC input.

[5] The compatibility matrix is available at http://h18004.www1.hp.com/products/blades/components/Compatibility-Matrix.html

Because the enhanced server blade enclosure splits the DC power into the left and right sides of each server blade enclosure, customers must use two power enclosures to configure AC line cord redundancy. Line feed redundancy is achieved between sides A and B of the two power enclosures by wiring enclosure 1 side A to AC input 1, and enclosure 2 side A to AC input 2, as shown in Figure 3.

Figure 3. AC redundant configurations for the standard and enhanced server blade enclosures



Combining standard and enhanced server blade enclosures

Some customers may choose to deploy both standard and enhanced server blade enclosures in the same rack to share the same power subsystem. Before doing so, administrators should be aware of firmware and redundancy requirements. HP encourages customers to upgrade standard server blade enclosures with the Server Blade Enclosure Upgrade Kit to take advantage of enhanced backplane components and provide a single, physical iLO port for the enclosure.

Maximum AC-redundant configurations for HP BladeSystem server blades

Tables 3, 4, and 5 in this section provide general guidelines for maximum 42U rack configurations with AC redundancy. The maximum configurations are based on either physical constraints or maximum power loads and are the same for 208V or 220V inputs. The guidelines were calculated using these assumptions:

- All server blades in a rack are the same model
- All models are configured with the maximum number of processors, memory, and two disk drives
- All configurations use the GbE2 interconnect switches
- All server blades are running at or near 100 percent average utilization rates using three-phase power

Therefore, actual server blade requirements may be significantly less than the maximum if server blades are configured with less hardware or are used at lower average workloads. It follows that these maximum rack configurations can be exceeded if the blade servers are configured with fewer processors, less memory, and so on.

The tables below are only examples of possible configurations. Refer to the HP BL p-Class Sizing Utility to determine specific requirements.[6]

NOTE: Customers can build larger rack configurations if they do not require AC redundancy. It is also possible to build a six-enclosure rack using the 1U power enclosure.

Table 3. Maximum configurations for ProLiant server blades using **mini-bus bars**, three-phase power of 208V input or higher, N+N redundant power supplies, and redundant AC.

Server	Max processors per blade	Max blades per 6U enclosure	Max 6U blade enclosures per 42U rack	Max blades per 42U rack	Power supplies required	3U power enclosures required
BL20p G3	2	8	5	40	**24**	**4**
BL25p	2	8	5	40	**24**	**4**
BL30p	2	16	5	80	**24**	**4**
BL35p	2	16	5	80	**24**	**4**
BL40p	4	2	5	10	**24**	**4**
BL45p	4	4	5	20	**24**	**4**
BL60p	2	8	5	40	**24**	**4**

[6] The HP BladeSystem Sizing Utility is available at http://h30099.www3.hp.com/configurator/calc/BL p-Class.xls

Table 4. Maximum configurations for ProLiant server blades using **scalable bus bars**, three-phase power of 208V input, N+N redundant power supplies, and redundant AC.

Server	Max processors per blade	Max blades per 6U enclosure	Max 6U blade enclosures per 42U rack	Max blades per 42U rack	Power supplies required	3U power enclosures required
BL20p G3	2	8	5	33-40 *	**12**	**2**
BL25p	2	8	5	40	**12**	**2**
BL30p	2	16	3	41-48 *	**12**	**2**
BL35p	2	16	4	58-59 *	**12**	**2**
BL40p	4	2	5	10	**12**	**2**
BL45p	4	4	5	20	**12**	**2**
BL60p	2	8	5	40	**12**	**2**

***Depends on processor type. See HP BladeSystem p-Class Sizing Utility for specific configuration options**

Table 5. Maximum configurations for ProLiant server blades using **scalable bus bars**, three-phase power of 220V input or higher, N+N redundant power supplies, and redundant AC.

Server	Max processors per blade	Max blades per 6U enclosure	Max 6U blade enclosures per 42U rack	Max blades per 42U rack	Power supplies required	3U power enclosures required
BL20p G3	2	8	5	40	**12**	**2**
BL25p	2	8	5	40	**12**	**2**
BL30p	2	16	4	50-57 *	**12**	**2**
BL35p	2	16	5	73	**12**	**2**
BL40p	4	2	5	10	**12**	**2**
BL45p	4	4	5	20	**12**	**2**
BL60p	2	8	5	40	**12**	**2**

***Depends on processor type. See HP BladeSystem p-Class Sizing Utility for specific configuration options**

Recommendations

The HP p-Class server blade enclosure with enhanced backplane components is required for deploying BL20p G3 (selected models), BL25p dual-core models, BL30p, BL35p, BL40p, BL45p, BL60p, and all future HP server blades. Refer to the HP BladeSystem enclosure compatibility matrix for

the most recent information about which server blade models require the enhanced server blade enclosure.[7]

HP makes the following recommendations for configuring the HP BladeSystem p-Class power subsystem:

- Use three-phase power for rack centralized power solutions
- Use 1U power enclosure where single phase power is required
- Design for redundancy
- Use the HP BladeSystem p-Class Sizing Utility
- Obtain real-time power information from iLO
- Configure power zones properly

Use three-phase power

Three-phase power is typically more efficient than single-phase power because it provides more than 150 percent of maximum available power provided by single-phase power. Three-phase power is also more stable than single-phase power since it has three voltage waves and is at peak voltage more of the time. HP BladeSystem p-Class systems require 30 or 32 amp, 200 to 240 VAC or a direct facility power source of –48 VDC power (±10 percent). To gain the maximum benefit from the dense server blade designs, HP recommends using the three-phase power enclosure because of its greater efficiency, scalability and higher power capabilities, particularly to support the latest microprocessors or double-density server blades such as the ProLiant BL30p series.

NOTE: NA/JPN and International three-phase power enclosures use different types of three-phase power.

Design for redundancy

To ensure continuous, redundant power, HP recommends using two power enclosures whenever a system includes enhanced server blade enclosures. Because the enhanced server blade enclosure splits the DC power into the left and right sides of each server blade enclosure, customers must use two power enclosures to configure AC line cord redundancy.

[7] The compatibility matrix is available at http://h18004.www1.hp.com/products/blades/components/Compatibility-Matrix.html

Use the Sizing Utility

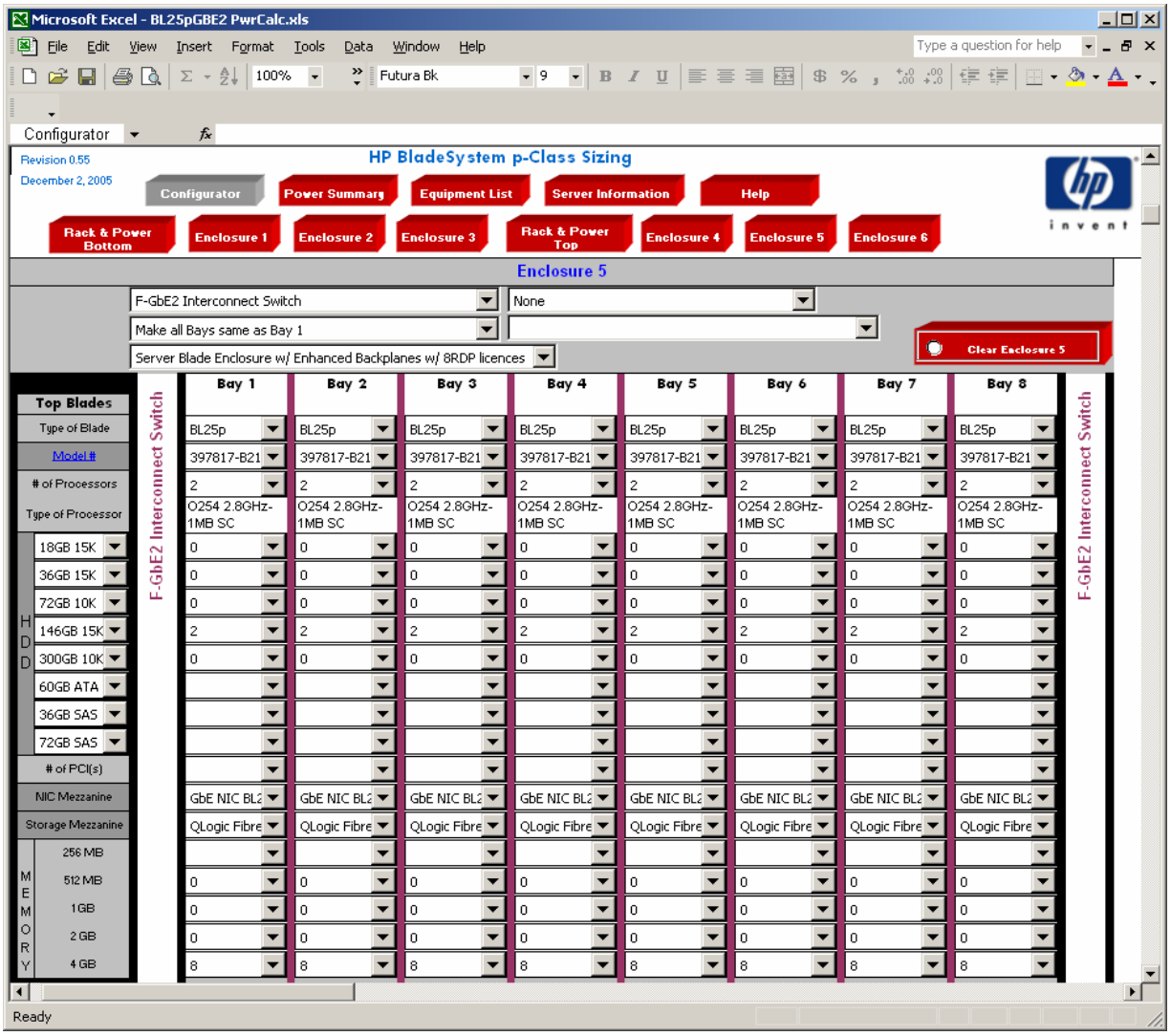
The HP BL p-Class Sizing Utility is a free tool available on the HP website.[8] It provides valuable information for planning, ordering components, and preparing a site for delivery and installation of HP BladeSystem solutions. Always use the latest version of the sizing utility to determine requirements. The user enters the desired server blade and enclosure configurations, chooses interconnects, and enters data center power information (Figure 4). Based on this user input, the Sizing Utility then calculates and displays:

- Maximum power specifications
- Heat generation and cooling requirements
- Summary table of server blade components in the rack (server blades, memory, processor, etc.)
- Number of power supplies and power enclosures needed for both redundant and non-redundant power configurations
- System weight
- Equipment list

NOTE: The HP BladeSystem p-Class Sizing Utility assumes maximum consumption from the configured components and a 100 percent server utilization to calculate the wattage requirements and BTU output for a given rack configuration. This maximum load is rarely seen in typical operating environments. HP gives these maximum figures to help customers plan conservatively for their data center deployments.

[8] The HP BladeSystem Sizing Utility is available at http://h30099.www3.hp.com/configurator/calc/BL p-Class.xls

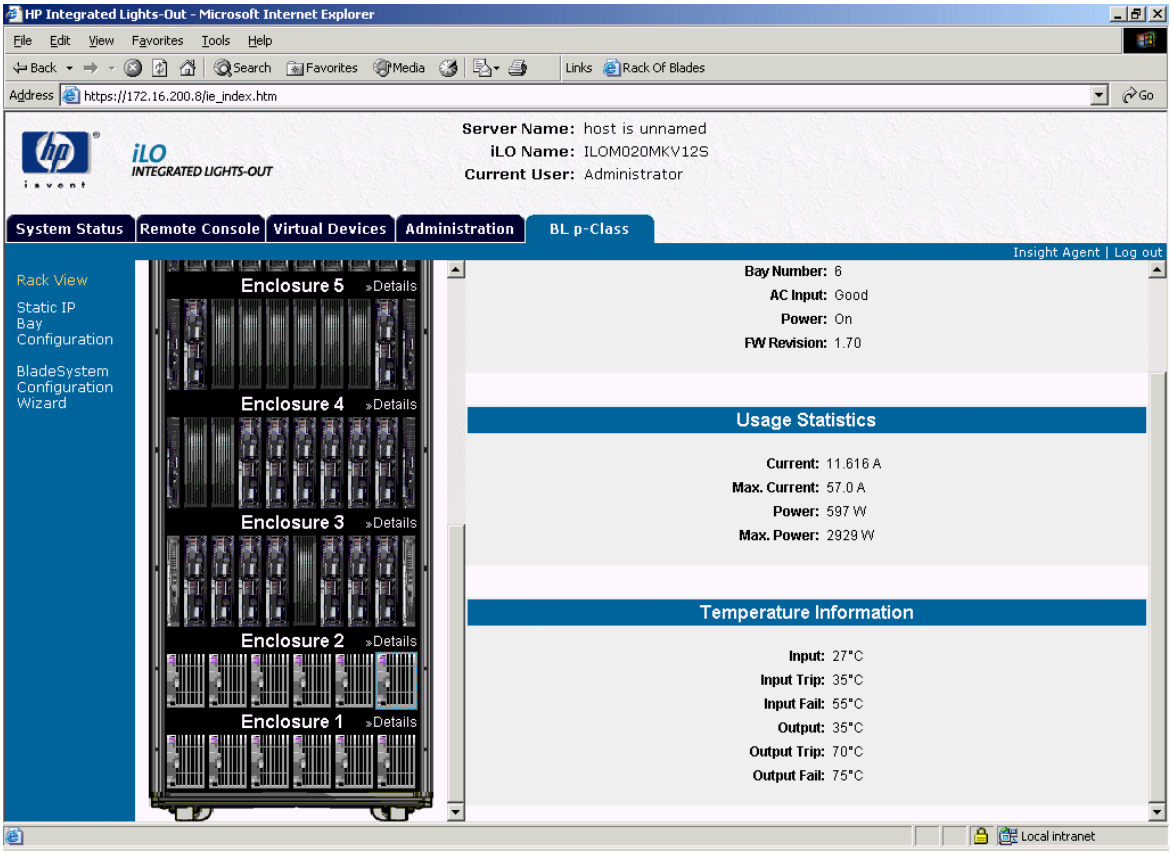
Figure 4. Example of the HP BladeSystem p-Class Sizing Utility interface



Obtain real-time power information from iLO

Real-time power information about individual power supplies is available through the iLO management processor on each server blade. Figure 5 shows an example of the version1.64 iLO interface.

Figure 5. Power information for the entire HP BladeSystem infrastructure is available through the iLO management processor on any installed server blade.



For diagnostic purposes only, power information is also available by using the serial port on the back of the power management module in each power enclosure. Users can hook up a standard null modem cable to connect a laptop or other management computer to the serial port and access the information using a terminal emulator program. Data delivered through this port is not generally delivered to the management infrastructure.

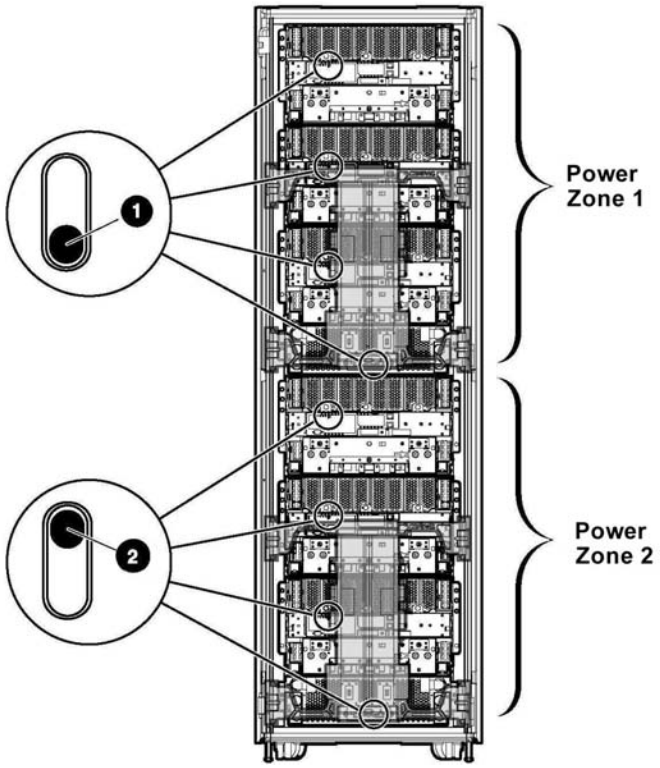
IT administrators can enable remote access to the serial port in two different ways. The HP Serial Console Server or the HP IP Console Switch with the Serial Interface Adapter allows remote access to serial devices via an IP network. HP Serial Console Server and HP IP Console Switch with Serial Interface Adapter can also be used for remote access to other devices with a serial port.

NOTE: Additional information about HP Serial Console Server and HP Serial Interface Adapter is available at this URL: www.hp.com/go/kvm

Properly configure power zones

For a system to function properly when using two mini bus bar power subsystems or when using a mixed 1U and 3U solution in a rack, two separate power zones must be configured (Figure 6).

Figure 6. A fully populated 42U rack requires two separate power zones to identify which power enclosures supply specific server blade enclosures.



Item	Description
1	Zone 1 switches set in the down (default) position
2	Zone 2 switches set in the up (secondary) position

Each power management module and each server blade management module has a two-position switch for setting the power zone for that module. All power configuration switches in the same zone must be set to the same position.

As of firmware release 2.20, however, there are important changes in how power zones are managed. In firmware releases prior to 2.20, there were only two power zones (zone 1 and zone 2) that were set by a switch on the rear of HP BladeSystem 3U power enclosures. Firmware 2.20 provides the capability to have up to six power zones. The power zone switch on the rear of the 3U power enclosure only has settings for zone 1 and zone 2; additional power zones start at 3 so they do not overlap existing power zones.

For legacy firmware, the switch remains on HP BladeSystem 3U power enclosures; however, firmware versions 2.20 and above do not use the switch. Power zones are set automatically by the firmware, based on rack topology.

Every power zone must include a power source and at least one server blade enclosure. In the pre-2.20 firmware environment, if a server blade enclosure were in zone 2 and the power enclosure supporting it were in zone 1, the server blades and switches in that sever blade enclosure would never power on automatically because the devices in the server blade enclosure must request power from a power source in their own zone to power on. If the power source is not in the same zone as the server blade enclosure, the request for power goes unanswered because there is no power available in that zone.

To ensure that all power enclosures and server blade enclosures are configured in the proper zone, all enclosures in a rack should be upgraded to firmware 2.20 or later at the same time to eliminate the possibility of enclosures being assigned to the wrong power zone. For example, if one enclosure in an infrastructure is upgraded to firmware 2.20 and the other enclosures are not upgraded at the same time, the following would result:

- The enclosure that is upgraded to 2.20 would be put into power zone 3
- The enclosures that are not upgraded would be placed in power zone 1 or power zone 2 (depending on the zone setting of the physical switch)

HP does not support mixed firmware versions within the same infrastructure. All enclosures should have the same firmware version. Once all the enclosures in the rack are upgraded to firmware 2.20, there should be no problem with enclosures being configured in the wrong power zone. In fact, the switch setting on the rear of the enclosure will no longer serve a functional purpose. After an upgrade to firmware 2.20, power zone 1 and power zone 2 switches are no longer used since the power zones are set automatically by the firmware based on rack topology, not switch settings.

NOTE: More information on upgrading firmware is available in Chapter 5 of the "HP ProLiant BL System Best Practices Guide" at this URL: http://h20000.www2.hp.com/bc/docs/support/UCR/SupportManual/TPM_351359-001_rev1_us/TPM_351359-001_rev1_us.pdf

Summary

The HP BladeSystem p-Class 3U power subsystem provides shared, fully redundant power for multiple enclosures deployed in racks in a data center environment. Single-phase or three-phase power options are available. Power distribution options include the BL p-Class scalable bus bar, the BL p-Class mini bus bar, the BL p-class power bus box and the dual power input kit for mini bus bar.

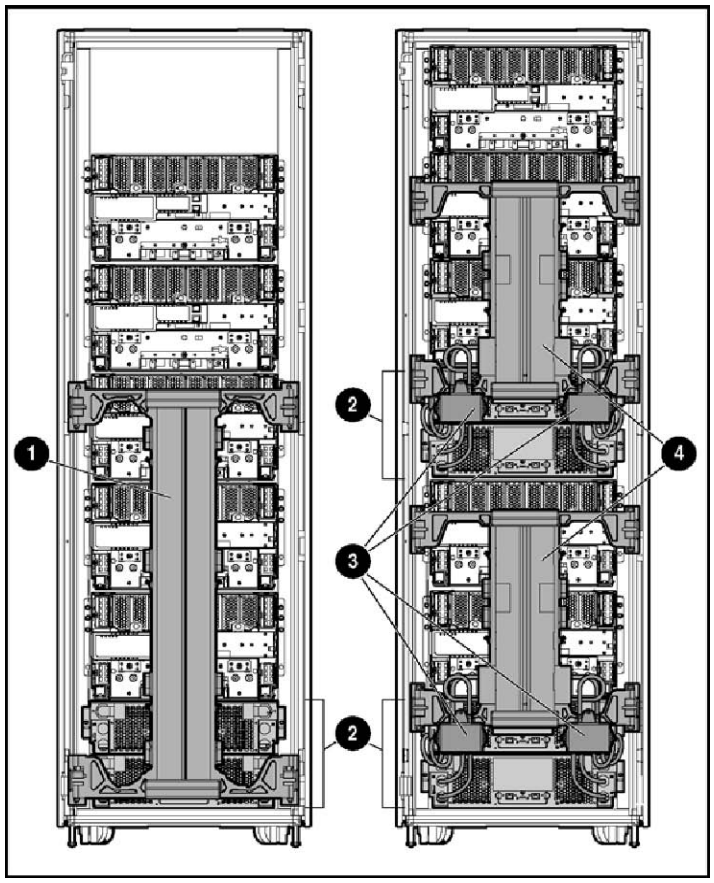
The HP BladeSystem allows customers to mix and upgrade components as needed: an enhanced server blade enclosure can be used in the same rack with a standard server blade enclosure, the standard server blade enclosure can be upgraded to an enhanced enclosure, single and three-phase power enclosures can be mixed, and mini bus bars can be upgraded to allow dual power enclosure configurations.

Appendix - Power distribution options

The options for HP BladeSystem p-Class power distribution illustrated in Figures A-1 and A-2 are:

- Scalable bus bar
- Mini bus bar
- Power bus box

Figure A-1. Scalable and mini bus bars



Item	Description
1	Scalable bus bars
2	Power supply enclosures
3	Dual Power Input Kit for Mini Bus Bar
4	Mini bus bars

Figure A-2. Power bus boxes

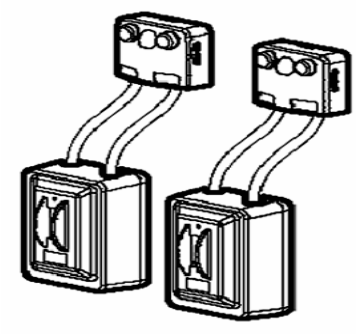


Table A-1 summarizes the characteristics of the power distribution solutions for HP BladeSystem p-Class server blades. Deploying an enhanced server blade enclosure requires two power enclosures to provide power redundancy.

Table A-1. HP BladeSystem p-Class power distribution options

Solution	Power enclosures supported	Server blade enclosures supported	Maximum rack space occupied
Scalable bus bar	2	5	36U
Mini bus bar	2*	3	24U
Power bus box	1	1	9U

* To attach two power enclosures to a mini bus bar, the Dual Power Input Kit for Mini Bus Bar option is required.

For more information

For additional information, refer to the resources listed below.

Resource description	Web address
General HP BladeSystem information	http://www.hp.com/go/bladesystem/
HP ProLiant BL p-Class 1U power enclosure	http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00588442/c00588442.pdf
HP ProLiant BL p-Class Sizing Utility	http://h30099.www3.hp.com/configurator/calc/BL p-Class.xls Or by following the planning tools link on the general HP BladeSystem webpage
HP BladeSystem p-Class Enclosure Installation Guide	http://h20000.www2.hp.com/bc/docs/support/SupportManual/c00172260/c00172260.pdf
HP BladeSystem p-Class enclosure compatibility matrix	http://h18004.www1.hp.com/products/blades/components/Compatibility-Matrix.html
HP BladeSystem drivers and firmware	http://h71028.www7.hp.com/enterprise/cache/80365-0-0-0-121.aspx Follow this link, then click on the support & documentation link for the individual BladeSystem product.
Technology briefs about HP BladeSystem	http://h18004.www1.hp.com/products/servers/technology/whitepapers/proliant-servers.html

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